

# METHOD FOR MANUFACTURING NON-VOLATILE MEMORY DEVICES

## Field of the Invention

5           The present invention relates to a method for manufacturing non-volatile memory devices; and, more particularly, to a method for manufacturing flash memory devices among the non-volatile memory devices.

## 10   Background of the Invention

          Generally, a semiconductor memory device is classified into a volatile memory device and a non-volatile memory device. The most volatile memory device is a dynamic random  
15   access memory (DRAM) and a static random access memory (SRAM), which is characterized in that it requires a steady flow of electricity to maintain its contents. As soon as the power is turned off, whatever data was therein is lost. Meanwhile, the non-volatile memory device almost composed of  
20   a read only memory (ROM) can hold its contents whenever power is not supplied.

          At present, the non-volatile memory device is classified into a floating gate type and a metal insulator semiconductor type, accumulated with 2 dielectric layers or  
25   3 dielectric layers, in aspect of a manufacturing process.

          The floating gate type memory device implements a data

holding using a potential well, and is represented by an erasable programmable read only memory (EPROM) tunnel oxide (ETOX) structure which is widely used in electrically EPROM (EEPROM).

5           In the meanwhile, MIS type stores data using a trap existed in a dielectric bulk, a dielectric-dielectric interface, and a dielectric-semiconductor interface. A metal/silicon oxide-nitride-oxide structure is a representative structure used in a flash EEPROM.

10           As a technology gets advanced, a system on chip (SOC) technique gets highlighted. Herein, the SOC technique means that various functions, such as Logics, Sonos, and Flasys are operable in single chip. However, these functions require a complex processing for implementing thereof.

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#### Summary of the Invention

It is, therefore, an object of the present invention to provide a method for manufacturing a non-volatile memory device that is appropriate to form a self-align flash memory.

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In accordance with a preferred embodiment of the present invention, there is provided a method for manufacturing a non-volatile memory device, comprising the steps of: (a) forming an oxide layer on a substrate; (b) implanting ions through the oxide layer to sequentially form a well in the substrate and a channel in the well; (c)

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removing the oxide layer; (d) depositing a tunnel oxide layer, a first polysilicon layer, and a nitride layer sequentially on the substrate; (e) etching the nitride layer, the first polysilicon layer, the tunnel oxide layer and the substrate based on a shallow trench isolation pattern, resulting in a shallow trench in which the substrate is etched by a predetermined depth; (f) filling the shallow trench with an isolation material; (g) performing a polishing until the nitride layer is exposed to form a shallow trench isolation; (h) removing the nitride layer to thereby protrude the shallow trench isolation; and (i) depositing an oxide-nitride-oxide layer and a second polysilicon layer sequentially.

#### 15 Brief Description of the Drawings

The above and other objects and features of the present invention will become apparent from the following description of preferred embodiment given in conjunction with the accompanying drawings, in which:

Figs. 1A to 1G illustrate a procedure for manufacturing a non-volatile memory device in accordance with the present invention.

#### 25 Detailed Description of the Preferred Embodiments

The preferred embodiment of the present invention will now be described in detail with reference to the accompanying drawings.

5 Figs. 1A to 1G show a procedure for manufacturing a non-volatile memory device in accordance with the present invention.

Referring to Fig. 1A, an oxide layer 12 is deposited on a whole surface of a silicon substrate 10.

10 Referring to Fig. 1B, ion implantations are performed into the surface of the silicon substrate 10, to thereby form a well 14 in an upper portion of the substrate 10 and a channel at a surface of the substrate 10 over the well 14. Herein, boron and phosphor are implanted for the well implantation and the channel implantation.

15 Referring to Fig. 1C, the oxide layer 12 is removed by a wet etch. And then, a tunnel oxide layer 16, a first polysilicon layer 18, and a nitride layer 20 are deposited sequentially.

20 Referring to Fig. 1D, based on a shallow trench isolation suitable to a specific critical dimension, an etching is performed from the nitride layer 20 to the substrate 10, resulting in a shallow trench in which the substrate 10 is etched by a predetermined depth.

25 Referring to Fig. 1E, the shallow trench is filled with an isolation material, e.g., a tetra ethyl ortho silicate (TEOS) 22.

Referring to Fig. 1F, a chemical mechanical polishing is performed until the nitride layer 20 is exposed. In the results, the shallow trench is filled with the isolation material so that a shallow trench isolation 23 is formed.  
5 Thereafter, the nitride layer 20 is removed by a wet etch to protrude a part of the shallow trench isolation 23.

Referring to Fig. 1G, an oxide-nitride-oxide layer 24 is deposited on a structure obtained in the previous step and then a second polysilicon layer 26 is deposited thereon  
10 to thereby complete the non-volatile memory device.

In accordance with the present invention, a non-volatile memory device is manufactured through the steps of forming a well and a channel in a silicon substrate, depositing a tunnel oxide layer, a first polysilicon layer  
15 and a nitride layer sequentially, and performing a trench etching thereof.

While the invention has been shown and described with respect to the preferred embodiments, it will be understood by those skilled in the art that various changes and  
20 modifications may be made without departing from the spirit and scope of the invention as defined in the following claims.